

On the Anatomy of the Prosobranch Genus *Pontiothauma*, E. A. Smith. By S. PACE. (Communicated by Professor G. B. HOWES, LL.D., D.Sc., F.R.S., Sec. Linn. Soc.)

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(PLATE 42.)

WHEN, through the kindness of Mr. E. A. Smith, of the British Museum, an opportunity was, some few years ago, afforded me to examine the two deep-sea molluscs which form the subject of the present note, I gladly availed myself of it, since the members of that fauna occupying the deeper regions of the ocean almost invariably present the morphologist with features of particular interest.

The molluscs in question formed part of the rich zoological booty which is being obtained by the Indian Marine Survey steamer 'Investigator.' Being submitted to Mr. Smith for identification, both species proved to be new to science; and, since they could not be relegated to any existing genus, Mr. Smith proposed* for their reception the new genus *Pontiothauma*, with type-species *P. mirabile*. The affinities of *Pontiothauma*, however, appeared to be by no means clear; for, while the shell of the type-species presents a very close resemblance indeed to the whelks, the external characters of the animal seemed to be quite *sui generis*. Mr. Smith therefore asked me to examine the soft parts in order to determine the systematic position of the genus. This was done; but, since my investigations had only been based upon single specimens, which, being unique, one was naturally anxious to damage as little as possible, and further material being promised, I refrained from publishing at the time the details of my results. However, *Pontiothauma* does not appear to have been again met with; and it would therefore seem expedient to place upon record the more important of such facts as could be made out from the original material.

From the few characters which are recorded below, it will be evident that the affinities of *Pontiothauma* are with the Mau-

* Ann. & Mag. Nat. Hist. ser. 6, vol. xvi. p. 2.

giliinæ* ; but so very little has yet been published † respecting the internal anatomy of other allied forms, that it is not at present possible to assign any precise position within the subfamily to the two species dealt with in this paper. So far as our present knowledge goes, the nearest allies of these two forms, which are evidently representatives of distinct sections, would appear to be *Pleurotomella*, Verrill, and *Spergo*, Dall ; and it is worthy of note that Dall ‡ describes *Spergo glandiniformis*, Dall, as possessing a rostral development which would seem to be not altogether unlike that of *Pontiothauma*.

In the *Toxoglossa* generally the pre-stomial region is much specialized and often enormously developed ; and specialization would seem to reach its maximum expression in the truly remarkable rostrum of *Pontiothauma mirabile*. It is difficult, in the absence of any information as to the habits of the animal, to suggest an adequate explanation for the structural modification observable in this form. The appearance of the rostrum in *P. mirabile* is rather suggestive of a suctorial apparatus ; or, it may perhaps be that it is expressive of a habit of burrowing in the ooze and of enveloping its prey within the expanded rostral disk. Dall has suggested that the somewhat similar arrangement met with in *Spergo* is due to the habit of gorging itself with large masses of protoplasmic material, such as Foraminifera, rather than of attacking animals of a higher order. It should be stated that microscopical examination of the contents of the rhynchodæum and of the alimentary canal has failed in either species to reveal any recognizable fragments of food-material : the contents consisted apparently merely of coagulated mucus.

PONTIOTHAUMA MIRABILE, *E. A. Smith*. (Pl. 42. figs. 1-9.)

The single specimen, the type-specimen, upon which the following notes are based was dredged in 1250 fathoms off the Malabar coast § by the 'Investigator.' It had been removed

* *Pontiothauma mirabile* is by far the largest Pleurotomoid species at present known ; the shell of the type-specimen has a length of 13.6 and a width of 5.2 centimetres.

† Dr. Dall, who has had the unique opportunity of examining the comparatively large number of deep-sea Pleurotomoids collected by the 'Albatross' and other American expeditions, has unfortunately as yet published only a few exceedingly slight and scrappy notes regarding their internal structure.

‡ Proc. U. S. Nat. Mus. vol. xvii. p. 681, pl. 24. fig. 1.

§ Ind. Mar. Survey Station, No. 125.

from its shell when I received it and was rather broken, and the tissues were so exceedingly hard as to render dissection difficult; moreover, the body-cavity had been cut into and the organs somewhat displaced.

The general appearance of the animal, as contracted in spirit, is shown by the figures (Pl. 42. figs. 1, 2, & 3). The body had evidently been entirely devoid of pigmentation. The surface of the foot is minutely granulated; but this may possibly be merely a *post-mortem* appearance.

The foot is ovate and much elevated; it is expanded and slightly bilobed in front and pointed posteriorly; and its anterior margin is very conspicuously duplicated. No trace of an operculum or opercular pad could be detected, neither was any pedal pore evident. The most remarkable feature of the external characters of this form is that to which allusion has already been made, namely, the enormous rostral development. The snout, even in the contracted state, constitutes a very considerable proportion of the whole body of the animal; and its finely wrinkled appearance suggests that it is capable of even much greater extension. It is a perfectly cylindrical structure terminating anteriorly in a large disk which bears the wide, circular rhynchostomial opening at its centre. This rostral disk appears capable of enormous expansion, its margin in the retracted condition being elaborately frilled and crenulated. The tentacles are short and apparently blunt: they are borne upon the sides of the rostrum just posterior to the origin of its terminal disk, and they are situated in a horizontal plane slightly below that of the axis of the rostrum (Pl. 42. fig. 2). No trace of eye-spots could be distinguished; it would not, however, be safe to assert that eyes are entirely absent in this form, for, not wishing to entirely destroy the unique specimen, the question of their non-existence has not been definitely decided by sectioning the head-region. Although the example dissected is a female, a rudimentary penis (P.) is present, and is situated immediately behind and a little below the right tentacle*. The mantle-margin is somewhat thickened, and it completely encircles the body, passing round the siphon and over the foot. The siphon (S.) is solid and fleshy, it is conical in form and is devoid of appendages.

The pallial cavity can be completely subdivided into infra- and

* The presence of a vestigial penis in the female would seem to be a not altogether uncommon occurrence among Toxoglossates.

supra-branchial chambers by means of two valvular folds of the mantle-edge. The osphradium, which is characteristically darkly coloured, measures about 10 millim. in length; it is broad, and the foliæ of its right side are much the more strongly developed. The lamellæ of the ctenidium are nearly equilateral. The terminal portions of the rectum and oviduct were missing from the specimen, and the renal organ was too fragmentary for description. The hypobranchial gland appeared but little differentiated, and there were no indications of any coloured secretion.

As will be seen from the figure (Pl. 42. fig. 3), the introvert apparatus presents greater complexity than is usually met with in the less highly specialized Prosobranchs*. The rhynchostome is a wide, circular opening at the centre of the terminal disk of the rostrum: it is supported upon a massive cartilaginous ring. This aperture leads into a spacious cylindrical chamber (Rh.'') occupying the whole interior of the rostrum. The walls of this rostral chamber are glandular and exceedingly muscular. Posteriorly it is bounded by a thick septum whose central opening is entirely closable by means of a powerful sphincter. Succeeding this is another shorter chamber (Rh.'') of the same calibre as the first, but having its walls quite thin and membranous. The lumen of this post-rostral chamber was completely filled by the contracted-up proboscis (I.). Regarding the homology of these two prestomial chambers, it is probable that they together represent the simple rhynchodæum of the Rhachiglossa, rather than that the anterior cavity is to be regarded as being pre-rhynchostomial, or the posterior one as an additional development. The introvert is a large, fleshy, tapering structure with a very minute external orifice at its extremity. Its interior is quite spongy by reason of the great development of innumerable cross-folds of the inner wall which almost obliterate its lumen. The plication appears to be very irregular, although with a certain tendency towards a spiral disposition. The alimentary canal is of wide calibre throughout its simple U-shaped course. The pharyngeal bulb (Pl. 42. fig. 4, B.M.), which opens into the proboscis by a wide circular opening, is short and somewhat pear-shaped; its walls are very massive and are supported upon cartilage; the interior is finely plicated longitudinally, the plicæ

* It is highly probable that further research will prove that the relationships of the introvert among the Toxoglossa are of an even higher order of complexity than is at present supposed.

being so disposed as to form a slight spiral gutter. The succeeding segment of the œsophagus (Oe.), which is separated from the pharyngeal bulb by an exceedingly deep cleft, is very thick-walled and somewhat laterally compressed; its interior is longitudinally plicated, but the plicæ are not so fine as are those of the pharyngeal bulb, and they become coarser towards the stomach. The stomach is expanded, and its inner wall shows several prominent longitudinal folds. The disposition of the ducts of the digestive gland appears to be similar to the condition met with in *P. abyssicola* (Pl. 42. fig. 11), and, as in that species, the intestine narrows considerably.

A well-developed Leiblein's gland of the typical "poison-gland" type is present. The gland itself and the mass of its much-convoluted duct lie to the right side of the œsophagus; but a noteworthy detail regarding this structure is that the duct enters the pharyngeal bulb upon its ventral face (Pl. 42. fig. 4, L.Gl.), whilst in the majority of Prosobranchs the œsophageal diverticulum appears to arise dorsally.

A pair of small salivary glands are associated with the minute radula-sac (Pl. 42. fig. 4, R.S.). They are compact and have a sharply recurved, narrow, distal prolongation such as occurs in *P. abyssicola* (Pl. 42. fig. 13, S.Gl.).

The radula consisted of 23 rows of the formula 1—0—1. The teeth (Pl. 42. figs. 5—9) are typically Toxoglossate; they are hollow, with subterminal external openings and have barbed extremities.

The nervous system having been torn before the specimen reached me, it is not practicable to give a satisfactory account of its characters. The cerebral ganglia, which occupy the normal position, are hardly at all separated from each other; while the pedal ganglia are situated towards the right side of the introvert sheath, and the cerebro-pedal connectives are exceptionally long and delicate.

PONTIOTHAUMA ABYSSICOLA, *E. A. Smith*. (Pl. 42. figs. 10—14.)

When describing this species Smith expressed some doubt as to the closeness of its affinity with *P. mirabile*; and the structure of the soft parts will certainly justify the removal of *P. abyssicola* from the genus *Pontiothauma*. Since, however, so little is yet known of the anatomy of other Pleurotomoids, it will perhaps be advisable to wait until further details are published regarding *Pleurotomella*, &c., before proposing another new sectional name for *Pontiothauma abyssicola*.

The single specimen (the type-specimen) examined by me had been dredged off the Kistna coast in the Bay of Bengal * by the 'Investigator' in 753 fathoms. The animal had been extracted from its shell before I received it; and unfortunately, as also in the case of *P. mirabile*, the body-cavity had been cut into and the parts somewhat displaced.

The foot is flattened and elongate, and bluntly pointed posteriorly; anteriorly it is truncated and slightly bilobed and has the angles considerably produced. The front margin of the foot is prominently duplicated and the cleft is very deep. There is no vestige of an operculum or opercular pad and no visible pedal pore. The rostral region is not so extensively developed nor so specialized as it is in *P. mirabile*; it is not so cylindrical as it is in that species and its terminal disk is smaller and less definite. The tentacles, again, are proportionately longer than they are in the type-species: and, unlike the condition in the latter, they bear prominent black eye-spots, which are situated posteriorly upon slight elevations at their bases. The tentacles are disposed laterally to the snout, and their axes, if produced, would approximately cut that of the rostrum. The slightly thickened mantle-margin is continuous right round the body. The siphon is very short and broad, and the mantle-margin forms a wide collar around its base. The penis is large and of complex structure; it is placed rather far forward and is not covered by the mantle; its general form is indicated in the figures (Pl. 42. figs. 10 & 11, P.). The spermatic duct is broad and unconvoluted; it is completely enclosed, and its external opening is at about the middle of the lesser curvature of the penis. The body had apparently been unpigmented.

The pallial cavity of this species presents considerable similarity to what obtains in *P. mirabile*; but the hypobranchial gland is more definitely developed than it is in that form: there was no indication of any coloured secretion. The osphradium is proportionately considerably larger than it is in *P. mirabile*, and its foliæ are nearly equal. The triangular gill-laminæ have their shortest edge disposed towards the rectum.

The condition of the introvert apparatus (Pl. 42. fig. 12) is less specialized than it is in *P. mirabile*. As in the latter species, the rhynchostome is furnished with a cartilaginous support; but the rhynchodæum is less completely subdivided, the transverse

* Ind. Mar. Survey Station, No. 134.

septum of *P. mirabile* being represented by an encircling fold which is probably quite incapable of sufficient extension as to form a complete septum. The posterior chamber appears comparatively short; and the introvert in the retracted condition extends well into the anterior chamber. The introvert is a perfectly conical structure with but a minute terminal aperture; its interior is not spongy as it is in the type-species.

The alimentary canal (Pl. 42. fig. 11) has the characteristic simple U-shape and is of wide calibre throughout its course. The pharyngeal bulb is ovoidal, with thick muscular walls, and opening into the proboscis by a large circular opening. Immediately posterior to the pharynx the œsophagus, where it is encircled by the nerve-ring, becomes constricted and then again enlarges; but the constriction is not nearly so sharp as it is in *P. mirabile*. The post-neural enlargement being most marked dorsally (Pl. 42. fig. 13, Oe.), the gut in this region appears laterally compressed. The lumen of this segment of the œsophagus is almost occluded by the enormous development of the longitudinal plication of its inner wall.

The radula-sac (R.S.) is minute; its duct enters the floor of the pharyngeal bulb (B.M.) at about its middle and considerably to the right side. The teeth (Pl. 42. fig. 14) of the radula are similar to those of *P. mirabile*; but they are shorter and stouter in proportion, and the terminal barb is represented by but a slight thickening.

The salivary glands (S.Gl.) are disposed one on either side of the radula-sac, into which their ducts open. They are somewhat retort-shaped structures; their elongated, sharply recurved, distal prolongations appear to pass into the body-wall.

The poison-gland (L.Gl.) is of the normal type; but, as in *P. mirabile*, its duct, which is very long and much convoluted, enters the pharyngeal bulb ventrally at a point a little behind and somewhat to the right of the radula-sac.

The nervous system being injured, no attempt has been made to work out its detailed arrangement. It is noteworthy that, as in *P. mirabile*, the pedal ganglia lie to the right side, and that, in addition, the cerebral ganglia are much displaced so as to lie almost below the œsophagus to the left side. Contrary to the condition met with in *P. mirabile*, the cerebral and pedal ganglia are separated by but short, stout connectives.